

60th Medical Group (AMC), Travis AFB, CA
INSTITUTIONAL ANIMAL CARE AND USE COMMITTEE (IACUC)
FINAL REPORT SUMMARY

(Please type all information. Use additional pages if necessary.)

PROTOCOL #: FDG20160022A

DATE: 29 November 2017

PROTOCOL TITLE: Endovascular Perfusion Augmentation for Critical Care (EPACC) as a Resuscitative Adjunct in a Swine (*Sus scrofa*) Polytrauma Model of Ischemia Reperfusion Injury.

PRINCIPAL INVESTIGATOR (PI) / TRAINING COORDINATOR (TC): Dr. Austin Johnson

DEPARTMENT: UC Davis

PHONE #: 608-712-7152

INITIAL APPROVAL DATE: 25 August 2016

LAST TRIENNIAL REVISION DATE: N/A

FUNDING SOURCE: Henry M. Jackson Foundation

1. RECORD OF ANIMAL USAGE:

Animal Species:	Total # Approved	# Used this FY	Total # Used to Date
<i>Sus scrofa</i>	44	20	20

2. PROTOCOL TYPE / CHARACTERISTICS: (Check all applicable terms in **EACH** column)

<input type="checkbox"/> Training: Live Animal	<input type="checkbox"/> Medical Readiness	<input type="checkbox"/> Prolonged Restraint
<input type="checkbox"/> Training: non-Live Animal	<input type="checkbox"/> Health Promotion	<input type="checkbox"/> Multiple Survival Surgery
<input type="checkbox"/> Research: Survival (chronic)	<input type="checkbox"/> Prevention	<input type="checkbox"/> Behavioral Study
<input checked="" type="checkbox"/> Research: non-Survival (acute)	<input type="checkbox"/> Utilization Mgt.	<input type="checkbox"/> Adjuvant Use
<input type="checkbox"/> Other ()	<input type="checkbox"/> Other (Treatment)	<input type="checkbox"/> Biohazard

3. PROTOCOL PAIN CATEGORY (USDA): (Check applicable) ☐ C ☒ D ☐ E

4. PROTOCOL STATUS:

***Request Protocol Closure:**

☐ Inactive, protocol never initiated

☐ Inactive, protocol initiated but has not/will not be completed

☒ Completed, all approved procedures/animal uses have been completed

5. Previous Amendments:

List all amendments made to the protocol. **IF none occurred, state NONE. Do not use N/A.**

For the Entire Study Chronologically

Amendment Number	Date of Approval	Summary of the Change
1	5 Dec 16	Procedures
2	15 Dec 16	Personnel, animal use, procedures, anesthetic/analgesic, objectives
3	11 January 17	Animal use, procedures

4	20 February 17	Personnel
5	6 March 17	Procedural
6	18 May 17	Personnel, animal use, procedures

6. **FUNDING STATUS:** Funding allocated: \$67,410.00 Funds remaining: \$ 0.00

7. **PROTOCOL PERSONNEL CHANGES:**

Have there been any personnel/staffing changes (PI/CI/AI/TC/Instructor) since the last IACUC approval of protocol, or annual review? X Yes No

If yes, complete the following sections (Additions/Deletions). For additions, indicate whether or not the IACUC has approved this addition.

ADDITIONS: (Include Name, Protocol function - PI/CI/AI/TC/Instructor, IACUC approval - Yes/No)

<u>NAME</u>	<u>PROTOCOL FUNCTION</u>	<u>IACUC APPROVAL</u>
Robert Faulconer	AI	Yes
Jeremy Cannon	AI	Yes
Steven Chu	AI	Yes

DELETIONS: (Include Name, Protocol function - PI/CI/AI/TC/Instructor, Effective date of deletion)

None.

8. **PROBLEMS / ADVERSE EVENTS:** Identify any problems or adverse events that have affected study progress. Itemize adverse events that have led to unanticipated animal illness, distress, injury, or death; and indicate whether or not these events were reported to the IACUC.

There were no problems or adverse events that delayed study progress, or needed to be reported to the IACUC.

9. **REDUCTION, REFINEMENT, OR REPLACEMENT OF ANIMAL USE:**

REPLACEMENT (ALTERNATIVES): Since the last IACUC approval, have alternatives to animal use become available that could be substituted in this protocol without adversely affecting study or training objectives?

No alternatives became available.

REFINEMENT: Since the last IACUC approval, have any study refinements been implemented to reduce the degree of pain or distress experienced by study animals, or have animals of lower phylogenetic status or sentience been identified as potential study/training models in this protocol?

No.

REDUCTION: Since the last IACUC approval, have any methods been identified to reduce the number of live animals used in this protocol?

No.

10. **PUBLICATIONS / PRESENTATIONS:** (List any scientific publications and/or presentations that have resulted from this protocol. Include pending/scheduled publications or presentations).

This work will be presented at the Easter Association for the Surgeons of Trauma in Florida in January. This work has resulted in one manuscript entitled **Location Is Everything: The Hemodynamic Effects of REBOA in Zone 1 versus Zone 3 of the Aorta**. This has been submitted to the Journal of Trauma and Acute Care Surgery for potential publication.

11. PROTOCOL OBJECTIVES: (Were the protocol objectives met, and how will the outcome or training benefit the DoD/USAF?)

The protocol objectives were met. We have developed a deeper understanding of Zone 1 versus Zone 3 aortic occlusion in the setting of hemorrhagic shock. From this data we have developed a new treatment algorithm for wounded soldiers in hemorrhagic shock when REBOA is going to be used.

12. PROTOCOL OUTCOME SUMMARY: (Please provide, in "ABSTRACT" format, a summary of the protocol objectives, materials and methods, results - include tables/figures, and conclusions/applications.)

Objectives:

Resuscitative Endovascular Balloon Occlusion of the Aorta (REBOA) is an emerging technology to augment proximal blood pressure during the resuscitation of patients with non-compressible torso hemorrhage. Currently, the choice of aortic placement, zone 1 versus zone 3, depends upon injury patterns, but remains a highly debated topic. We sought to compare the proximal hemodynamic support provided by Zone 1 versus Zone 3 REBOA placement, and the degree of hemodynamic instability upon reperfusion following intervention.

Methods:

Anesthetized swine underwent controlled hemorrhage of 25% total blood volume, followed by 45 minutes of Zone 1 REBOA, Zone 3 REBOA, or no intervention (control). They were then resuscitated with shed blood, aortic balloons were deflated, and 5 hours of critical care ensued prior to euthanasia. Physiologic parameters were recorded continuously, and blood was drawn for analysis at specified intervals. Significance was defined as $p < 0.05$.

Results:

There were no significant differences between groups at baseline or during the initial 30 minutes of hemorrhage. During the intervention period, average proximal MAP was significantly greater in Zone 1 animals when compared to Zone 3 animals (127.9 ± 1.3 mmHg versus 53.4 ± 1.1 mmHg), and greater in Zone 3 animals when compared to control animals (42.9 ± 0.9 mmHg). Lactate concentrations were significantly higher in Zone 1 animals (9.6 ± 0.4 mmol/L) when compared to Zone 3 animals (5.1 ± 0.3 mmol/L) and control animals (4.2 ± 0.8 mmol/L).

Conclusion:

In our swine model of hemorrhagic shock, Zone 3 REBOA provided minimal proximal hemodynamic support when compared to Zone 1 REBOA, albeit with less ischemic burden and instability upon reperfusion. In cases of impending hemodynamic collapse, Zone 1 REBOA placement may be more efficacious regardless of injury pattern, while Zone 3 should only be reserved for relatively stable patients with ongoing distal hemorrhage.



M. Austin Johnson, MD, PhD

12/21/17
(Date)

Attachments:

Attachment 1: Defense Technical Information Center (DTIC) Abstract Submission (Mandatory)

Attachment 1

Defense Technical Information Center (DTIC) Abstract Submission

This abstract requires a brief (no more than 200 words) factual summary of the most significant information in the following format: Objectives, Methods, Results, and Conclusion.

Objectives:

Resuscitative Endovascular Balloon Occlusion of the Aorta (REBOA) is an emerging technology to augment proximal blood pressure during the resuscitation of patients with non-compressible torso hemorrhage. Currently, the choice of aortic placement, zone 1 versus zone 3, depends upon injury patterns, but remains a highly debated topic. We sought to compare the proximal hemodynamic support provided by Zone 1 versus Zone 3 REBOA placement, and the degree of hemodynamic instability upon reperfusion following intervention.

Methods:

Anesthetized swine underwent controlled hemorrhage of 25% total blood volume, followed by 45 minutes of Zone 1 REBOA, Zone 3 REBOA, or no intervention (control). They were then resuscitated with shed blood, aortic balloons were deflated, and 5 hours of critical care ensued prior to euthanasia. Physiologic parameters were recorded continuously, and blood was drawn for analysis at specified intervals. Significance was defined as $p < 0.05$.

Results:

There were no significant differences between groups at baseline or during the initial 30 minutes of hemorrhage. During the intervention period, average proximal MAP was significantly greater in Zone 1 animals when compared to Zone 3 animals (127.9 ± 1.3 mmHg versus 53.4 ± 1.1 mmHg), and greater in Zone 3 animals when compared to control animals (42.9 ± 0.9 mmHg). Lactate concentrations were significantly higher in Zone 1 animals (9.6 ± 0.4 mmol/L) when compared to Zone 3 animals (5.1 ± 0.3 mmol/L) and control animals (4.2 ± 0.8 mmol/L).

Conclusion:

In our swine model of hemorrhagic shock, Zone 3 REBOA provided minimal proximal hemodynamic support when compared to Zone 1 REBOA, albeit with less ischemic burden and instability upon reperfusion. In cases of impending hemodynamic collapse, Zone 1 REBOA placement may be more efficacious regardless of injury pattern, while Zone 3 should only be reserved for relatively stable patients with ongoing distal hemorrhage.

Grant Number: _____

From: Henry M. Jackson Foundation

****If you utilized an external grant, please provide Grant # and where the grant came from. Thank you.**